

ON THE SUPPOSED NUMERICAL PREPONDERANCE
OF THE MALES IN ODONATA.

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Those entomologists who have paid any attention to the "Odonata," or Dragonflies, have all agreed in stating that the males outnumber the females very considerably in most, if not in all, of the species. It is not necessary here to give a lengthy list of quotations from European or American authors who have made this observation; it is sufficient to quote M. René Martin, one of the very best authorities on the Odonata, and one who has an extensive knowledge of many of our Australian species. Speaking of *Xanthagrion erythroneurum*, one of the Australian *Agrionidae*, he says, "Les males semblent être plus nombreux que les femelles; ce qui est un cas frequent chez beaucoup d'espèces d'Odonates."* The statement can be well borne out by anyone who will take the trouble to examine any extensive collection of Odonata from any part of the world. It is generally found that in collections the males outnumber the females by nearly two to one. One may well doubt, however, that Nature has struck such an uneven balance between the sexes. In this paper I shall endeavour to set out the reasons which have led to the prevailing view, and to show that in reality it is not the case, but that the numbers of the sexes are approximately equal.

My own collection, made in New South Wales and Queensland during the past season, is no exception to the general rule.

* A List of Dragonflies of Australia: J. G. O. Tepper; annotated by M. René Martin.

Knowing that a day's collecting generally yields many more males than females of any given species, I have always made great efforts to secure sexual equality in my series by searching out the haunts of the females. The final result appears as follows:—Out of a total of 563 set specimens, 352 are males and 210 females, a proportion of 5 to 3 in favour of the males. This is, however, stating the case unfairly, for out of several hundred unset specimens which I have collected besides, nearly all are males. Taking a total of over 800 specimens, I find that under 300 are females; so that the proportion is in reality very nearly 2 to 1. Turning to species, out of 90 species collected, only five species are unrepresented by male specimens; while in no less than 26 cases have I failed to secure the female of a particular species at all. This is a remarkable result, and appears to make it extremely doubtful whether the numerical equality of the sexes really holds in the "Odonata."

There are, however, many reasons why a collector always captures many more males than females. The males are the more conspicuous of the two, the more brilliantly coloured, and more frequently on the wing. Moreover they love to congregate in marshy spots and along the borders of creeks and rivers where one is accustomed to search for dragonflies, while the females often retire into the bush or hide themselves in the herbage. The female, too, is fond of coming out to feed at dusk, when crowds of gnats and mosquitoes fall an easy prey to her. I have a specimen of *Telephlebia Godefroyi*, a female, which flew into a lighted room about 10 o'clock at night, and a female of *Hemianax Papuensis* taken at an arc-light in the city. I do not know of any case in which a male has been taken so late at night. On one occasion an hour's collecting on the borders of a large lagoon in Northern Queensland yielded me nearly two dozen *Rhyothemis graphiptera*, all males; but a walk of a mile or more through the bush and back yielded four females and no males. On another occasion I took over a dozen *Synthemis eustalacta*, all males, in a marsh on the Blue Mountains; on the way home two specimens were captured far from any water; these were both females.

Again, a dozen males of *Diplacodes melanopsis* were taken by me one afternoon round a small pond near the Clarence River; in the bush some hundreds of yards away I took four females and saw only one male. The female of *D. bipunctata*, too, was common in this spot, but I succeeded in taking only one male. Still another species of *Diplacodes*, *D. hamatodes*, is abundant along many small creeks and rivers; yet I never succeeded in taking the female of this species until one day I returned home along the railway line some distance from any water. In one of the cuttings the females simply swarmed, but I saw only one male. On another occasion I collected along 13 miles of railway track in Northern Queensland, mostly through dense bush; out of 21 specimens taken, 17 were females, and two of them, which I caught actually *inside a tunnel*, were females of a species of which I have never seen the male.

These facts, I think, prove conclusively that, except during oviposition, the males and females are in many instances quite separated, and only those collectors who will take the trouble to search in out of the way places, often far from water, will be able to obtain a good series of females. That this separation and retirement of the females is the reason for the apparent numerical superiority of the males, there can be very little doubt.

But something more than this is required to prove the actual numerical equality of the sexes. Even when searching for the females in their special haunts, it is only on very few occasions that they will be found in anything like the abundance of the males in *their* special haunts. A glance at the cases of *R. graphiptera* and *D. melanopsis* given above (and many other instances could be given) still leaves us with the conviction that the males are greatly in the majority. To prove that either this or the contrary is really the case, it would be necessary to show the proportion that actually exists among the nymphs of any given species. This I have endeavoured to do by rearing a large number of the nymphs of any given species. The nymph that is most easily obtained around Sydney is that of *Lestes Leda*, one of our commonest Agrionids, and one

moreover in which the proportion of two to one in favour of the male can easily be shown to prevail in the case of the perfect insect. I have taken this insect in many localities around Sydney, and wherever it occurs I have found the males far more numerous than the females. The result obtained then by breeding out a number of the nymphs should carry great weight. During last season I kept in my aquarium about a hundred nymphs of this species. These nymphs were taken from waterholes and small creeks without any selection of the darkest or largest forms; in fact every specimen brought out of the water by the net was put into the aquarium. One only, a fine and healthy specimen of a very dark form, was separated from the rest and put into a small jar for observation. During August and September of last year many of these nymphs emerged from the aquarium. The period of observation was just one month, from August 8th to September 7th, none emerging after the latter date. The following is a careful record of the sex and date of appearance of the specimens:—

DATE.	NO. OF MALES.	NO. OF FEMALES.
Aug. 8th.....	...	1
„ 13th.....	1	...
„ 18th.....	...	1
„ 19th.....	...	1
„ 21st.....	...	2
„ 23rd.....	...	1
„ 25th.....	...	1
„ 27th.....	3	1
„ 28th.....	...	1
Sept. 1st.....	1	1
„ 3rd.....	2	...
„ 4th.....	3	1
„ 5th.....	2	...
„ 7th.....	1	1
Total.....	13	12

One of these, the male that emerged on Aug. 13th, was the one that had been specially selected and separated for observation. Since he had the advantage over the others in an abundance of food, which the others certainly had not, and since he

was a picked specimen, I propose to leave him out of account, both as regards his early date of appearance and as affecting the numerical ratio of the sexes. We then have the following remarkable result—remarkable, I mean, in view of the supposed numerical inequality of the sexes—that out of 100 nymphs 24 bred out, and of these exactly half were males and half females.

With other species I had not the same success in breeding. The nymphs of *Ischnura delicata*, of which I had about a score, nearly all fell victims to the rapacious nymphs of larger species. Of four which emerged, two were males and two females.

It would be interesting to breed a large number of nymphs of other common species in order to see whether the result given by *Lestes Leda* is really typical of the generality of species. Of this, however, there can be very little doubt. To my mind, the experiment proves the ratio of the numbers of the sexes to be one almost of equality in any given species.

The other fact to be noticed is that the females of *L. Leda* appear before the males (leaving out of account the selected specimen). The first female appeared on Aug. 8th and the first male on Aug. 27th, nearly three weeks later. This has to be borne in mind when collecting. In the early part of the season I have always found the females of species before the males. It seems probable that the females fly early near their breeding places and later on retire into the bush or conceal themselves in the herbage, only appearing again in company with the males for oviposition. This, then, would account for collectors who are out in mid-season only obtaining a few females.

There is one subfamily, the *Aeschninae*, which appears to be an exception to the general rule. In this subfamily the number of females captured is nearly always equal to, if not actually in excess of, the number of males. Thus out of 38 specimens taken by me last season, 18 were males and 20 females. There were twelve species represented; in four cases I did not obtain the male, and in four cases also I failed to obtain the female. In this case, then, the rule of numerical equality of the sexes is borne out in collecting. The reason appears to be that they are

by far the swiftest and strongest of our Dragonflies, and that therefore neither the male nor the female relies very much upon concealment, both hawking freely together over the creeks and rivers.

We conclude, then, that the ratio of numbers of the sexes in the "Odonata" is a ratio of equality; the idea of the preponderance of the males suggested by a consideration of existing collections, and voiced from time to time by many eminent naturalists, is not borne out by rearing a large number of nymphs, and has its origin in the causes suggested above.